Kispiox Timber Supply Area

Vegetation Resources Inventory
Strategic Inventory Plan

Prepared by:
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With assistance from IRC Spatial Data Group Inc.

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FORSITE
Forest Management Specialists

Executive Summary

The current inventory within the Kispiox Timber Supply Area (TSA) does not meet the existing or future needs of resource managers and stakeholders. To satisfactorily address resource management issues a Vegetation Resource Inventory is planned for the Kispiox TSA.

This Vegetation Resource Inventory (VRI) Strategic Inventory Plan (VSIP), outlines the VRI activities and products needed to adequately address forest management issues identified by the stakeholder group and the Chief Forester as detailed in the Kispiox Timber Supply III (January 2008) recommendations. On behalf of the Ministry of Forests and Range (MOFR), BC Timber Sales – Skeena Business area retained Forsite Consultants Ltd. and IRC Spatial Data Group Inc. to prepare this plan.

The current inventory does not adequately provide sufficient and/or accurate information to address current management needs as well as data required for improving modeling assumptions for TSR4. Specifically, the current inventory does not provide:

- the data required to support the development of a cedar strategy
- differentiation between Abies lasiocarpa and Abies amabilis;
- accurate identification of the operable landbase;
- sufficiently detailed stand attributes for deciduous stands that are important for habitat and forest management purposes;
- accurate estimates of stand attributes to sufficiently address hydrological integrity issues and mapping of wildlife habitat areas;
- accurate volume or stand height estimates over the operable landbase;
- spatially accurate location of the polygon boundaries;
- sufficient stand information of immature stands to help address hydrology, wildlife and forestry management issues;
- sufficient data in protected areas;
- accurate merchantable volume estimates of the mature component.

A VRI will help resource managers and stakeholders to address the above issues. The VRI activities and products identified for addressing these forest management issues include:

1) Phase I photo interpretation
2) Phase II ground sampling
3) NVAF tree data collection
4) Data analysis and database attribute adjustment.

The objective of the VRI is to improve the accuracy of forest stand inventory attributes including: age, height, volume, site index and decay estimates, and to provide a solid inventory foundation to address TSA issues of operability, wildlife management and hydrological integrity.

The area to be inventoried is 1.23 million ha. The total budget for completing the VRI is estimated at $2,595,675. This inventory is planned to span the 2008-2011 fiscal years, with anticipated funding from the provincial government as part of the VRI focused funding initiative. The specific allocation of the budget is as follows:

VRI Phase/Task	Inventory Activity	Unit	# Units	Unit Cost $ / Unit	Total Cost $	Comments
I	**Photo Acquisition, Aerial Triangulation, Scanning, Proj. Mgmt**	mapsheet	15	4,807[1]	72,105	Based on having to re-fly two lines in the northern portion of TSA. This will make AT most cost and time efficient. Includes 10% proj. mgmt fees.
I	**Phase I VPIP**	TSA		15,000	15,000	Based on historical rates.
I	**Photo Interpretation**	hectare	1,232,000	1.52	1,872,640	Based on historical rates.
I	**3rd party Quality Assurance**	hectare	1,232,000	0.05	61,600	Based on historical rates.
Total Phase I Photo Interpretation Costs					**2,021,345**	
II	**Phase II VPIP**	TSA		20,000	20,000	Includes sample design and sample package preparation. Based on historical rates.
	Ground Sampling	plot	104	3200	332,800	$2200 per plot costs, $1000 heli costs per plot
	3rd party Quality Assurance	plot			33,280	10% of ground sample costs
	Non-standard Data Collection (Interior Log Grades)[2]	plot			4850	0.25 hr/non-enhanced plot 1.0 hr/enhanced plot $100/hr (est)
II	**NVAF**	tree	120	1200	144,000	$900/tree + helicopter
	3rd party Quality Assurance	tree			14,400	10% of NVAF costs
Total Phase II costs- Ground Sampling component					**549,330**	
III	**Statistical analysis and adjustment**	TSA			$25,000	
Total Phase III costs- Statistical Adjustment					**$25,000**	
GRAND TOTAL OF KISPIOX VRI					**$2,595,675**	

The estimated costs of completing ecosystem mapping for this TSA vary depending upon the method taken:

- TEM: $2,135,000-2,684,000[3]
- PEM: $536,800-793,000[4]

[1] The costs associated with flying only the missing flight lines then attempting to create AT models between the new and existing flight lines is believed to be greater than the time and costs associated with re-flying the mapsheets as one entire unit. (Pers. Comm with Ken Blagborne). Therefore, the costs are based on re-flying the entire remaining mapsheets.

[2] Call grading to Interior Log Grading standards is considered non-standard VRI data collection. Variances for non-standard data collection will likely not receive funding through the Forest Investment Account.

[3] Excluding helicopter costs

[4] Excluding helicopter costs.

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Acknowledgements

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1 Introduction

1.1 Background

The Vegetation Resources Inventory (VRI) is a resource inventory designed to support, most notably, the Timber Supply Review (TSR) process, as well as numerous other resource based analyses initiated regularly across the province by resource managers. Undertaking a VRI project requires completing a VRI Strategic Inventory Plan (VSIP), which is a process that includes the development of a VRI investment plan built upon input from local stakeholders regarding forest management issues within the management unit. The objective of the VSIP, when completed, is to provide guidance to the future investment of VRI activities and products needed to address identified forest management and inventory issues in the TSA.

BC Timber Sales (BCTS) has undertaken the responsibility of overseeing the completion of the VRI Strategic Inventory Plan (VSIP) in the Kispiox TSA.

The Kispiox TSA stakeholders group is comprised of participants operating within the Kispiox TSA, including:

- Bell Pole Canada Inc.
- BC Timber Sales
- Canema Timber Ltd.
- Kitwanga Lumber Company Ltd.
- Kispiox Forest Products Ltd.
- Gitxsan Forest Enterprises
- Ministry of Forests and Range (MoFR) represented by the Skeena-Stikine Forest District and the Northern Interior Forest Region.

These individual groups provided input into the VSIP development, which was prepared by Forsite Consultants Ltd. with technical support from IRC Spatial Data Group. The VSIP provides direction for the completion of the next planning step in the VRI process, which is the development of a project implementation plan (VPIP). A VPIP is a more detailed plan providing operational direction to the implementation of VRI activities identified in the VSIP.

1.2 Vegetation Resources Inventory

Prior to undertaking a VRI, it is important to understand the components of this inventory, as there are numerous activities that can be undertaken in combination, or individually. The VRI consists of the following components:

- Phase I photo interpretation
    - Delineation of vegetated and non-vegetated polygons;
    - Field calibration;
    - Polygon attribute estimation;
    - Digital capture of attributes and polygon boundaries to produce new forest cover maps.

- Phase II- ground Sampling
    - Information is collected in ground samples for purposes of determining how much of a given attribute is in the landbase.
    - There are two parts to this phase:
        - Establishment of cluster samples (five-point cluster samples) that are randomly established across the landbase;
            - These can be timber emphasis plots and/or full plots which also measures vegetation attributes
        - Destructive sampling that measures and corrects for errors in the estimation of net close utilization tree volume (which is later used to calculate the net volume of a stand).
- Analysis and Adjustment
    - Data analysis is the process of compiling and comparing the Phase II ground samples to the Phase I photo estimates in order to determine the relationship between these two datasets;
    - Applying the determined relationship to the photo interpreted estimates results in an attribute adjustment to remove any bias that may have been introduced by the photo interpreter.

Which VRI activities are undertaken largely depends upon the management issues present on the landbase.

It is the current provincial standard that a VSIP be completed prior to initiating a VRI. This is to ensure that the inventory is tailored to address the issues identified in the landbase. This VSIP serves this purpose.

1.3 VRI Overriding Principles

The implementation of VRI throughout the province is based on the following guidelines:

- that inventory projects are implemented to satisfy identified business needs as defined in the VSIP and VPIP documents. The VSIP identifies the general strategic forest management and inventory issues for a specific land area, and lists the activities and products required to address those issues; the VPIP identifies the operational priorities and provides detailed information regarding the implementation of the proposed VRI activities.
- To develop VRI products in a coordinated and structured way.
- To implement inventory projects following approved standards developed by the Resource Information Standards Committee and located at: http://ilmbwww.gov.bc.ca/risc/pubs/teveg/index.htm.
- To ensure that there is statistical confidence in timber value estimates.

1.4 The VRI Planning Process

The VRI planning process requires that a Strategic Inventory Plan and a Project Implementation Plan be developed for a forest management unit. The Strategic Inventory Plan (VSIP) is a strategic plan that identifies various VRI products or activities that are required to address identified forest management issues and provides strategic direction for their implementation. The Project Implementation Plan (VPIP) provides additional details regarding the various VRI activities including implementation details such as costs, priority areas, schedules, coordination, individual plot locations and roles

and responsibilities. Both documents seek to ensure that the identified VRI products address important management issues in priority areas. This VSIP outlines the framework for implementing the VRI products and should be consulted in the development of the VPIP, and was developed under the MoFR VRI planning process, following the provincial guidelines available at:

http://www.for.gov.bc.ca/hts/vri/standards/plan/preparing_vri_strategic_inventory_plan.doc

Other documents referenced in this VSIP include:
- Kispiox TSA Inventory Audit- November 1999
- Kispiox Timber Supply Review III- Timber Supply Analysis Report- March, 2007
- Kispiox Timber Supply Area Rationale for AAC Determination- January, 2008

1.5 **Funding**

The VRI program outlined within this VSIP is subject to funding from the provincial Forest Investment Account (FIA). Currently, funding for VRI activities are FIA eligible. It is expected that this program will be funded by the provincial government as part of the VRI focused funding initiative.

Non-standard data collection suggested within this VSIP may be considered an eligible FIA expenditure upon the submission and approval of a request for variance to standards. If the requested variance to standards is not approved, then other sources of funding need to be secured to fund these non-standard activities.

An approximate cost for the projects identified in this Plan has been developed utilizing historic costs from similar projects, and totals approximately $2,595,675.

2 Business Considerations

2.1 **First Nations**

Five First Nations have asserted traditional territories within the Kispiox TSA. These are:
- Gitxsan First Nation
- Gitanyow First Nation
- Office of the Wet'suwet'en (and the Moricetown Band)
- Lake Babine Nation (and the For Babine Band)
- Kitselas First Nation

Through various initiatives, the provincial government has embarked on the principle of capacity building with First Nations. The VRI activities identified within this plan can be utilized as further support and additional details regarding this endeavor will be developed in more the detailed VPIP plans.

2.2 **Land and Resource Base**

The Kispiox Timber Supply Area (TSA) encompasses 1.23 million hectares in the northwestern portion of the province. Approximately 57 percent of the TSA land base is

considered to be productive forest land[5]. The TSA is bordered to the north by the Nass and Prince George TSAs, to the west by the Kalum and Cranberry TSA's, and the Bulkley TSA to the south and east (Figure 1). The Ministry of Forests and Range-Skeena-Stikine Forest District office administers this TSA.

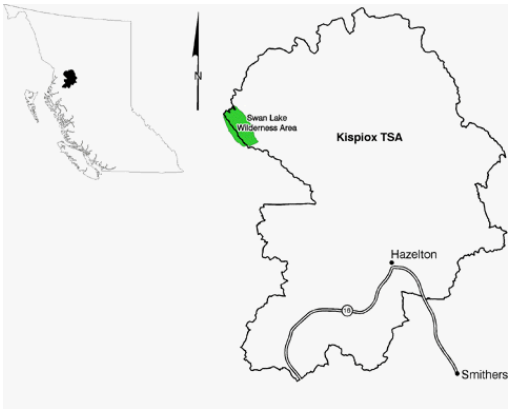


Figure 1 Kispiox TSA

The topography of the TSA consists of mountain ranges with wide intervening river valleys. The confluences of the Skeena and Bulkley rivers as well as the Babine and Kispiox Rivers are major features within the TSA. The dominant tree species occurring on the timber harvesting land base are western hemlock and subapline fir (balsam), with smaller components of spruce, lodgepole pine, western red cedar, amabilis fir and cottonwood. The TSA contains portions of six biogeoclimatic zones including: Interior Cedar-Hemlock (ICH), Sub-boreal Spruce (SBS), Englemann Spruce-Subalpine Fir (ESSF), Coastal Western Hemlock (CWH), Mountain Hemlock (MH) and Alpine Tundra (AT). Table 2 provides a summary of area and proportion of crown forested landbase (CFLB) and Timber Harvesting Landbase (THLB) by biogeoclimatic ecosystem classification (BEC) variant. This table also shows the percentage of each variant that is within the THLB.

Table 1 Area of CFLB and THLB by Biogeoclimatic Ecosystem Classification Variant for the Kispiox Timber Supply Area[6]

Zone	CFLB (ha)	THLB (ha)	THLB (%)	Percent BEC Variant in THLB (%)
AT	1005	-	-	-
CWHwx2	56,613	25,127	7.7	44.4
ESSFmc	37,129	25,204	7.7	67.9
ESSFWVP	226,518	73,399	22.4	32.4
ESSFwvp	10,898	1,738	0.5	16.0
ICHmc1	165,138	96,792	29.5	58.6
ICHmc2	157,055	86,161	26.3	54.9
MHmm2	14,499	3,125	1.0	21.6
MHmmp2	2,602	138	0.0	5.3
SBSmc2	38,450	16,152	4.9	42.0
Total	709,908	327,837	100.0	

[5] Kispiox TSR3 Timber Supply Analysis Report, March, 2007
[6] Kispiox TSR3 Timber Supply Analysis Report, March, 2007

Hemlock and balsam leading stands dominate the TSA (76%), with smaller components of spruce (12%), pine (9%), cedar (1%), and cottonwood and other species (2%) (Fig. 1). Approximately 77% of the THLB is above the minimum harvest age.

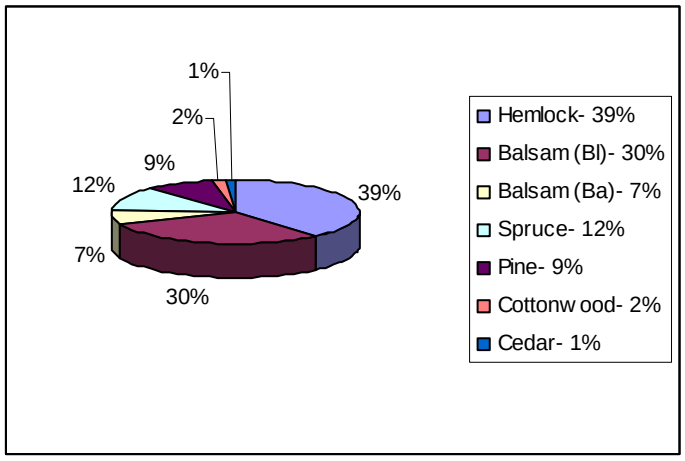


Fig. 1 Species Representation by Area

Of the total landbase of the Kispiox TSA, 697 736 hectares (57%) are considered productive forest land managed by the Ministry of Forests and Range. Currently, 327,837 hectares are considered to be suitable and available for timber harvesting. This represents 47% of the forested landbase, or 27% of the total TSA landbase

Table 2a and 2b provides a summary of key information about the landbase classification within the area.

Table 2a Kispiox TSA Area Summary[7]

Landbase Classification	Productive Forest Area (ha)	Final Area	% of Total Area	% of Productive Forest
Total TSA Area		1,224,856	100	
Not managed by the BCFS		149,998	12	
Non-forest and non-productive		376,309	31	
Non-commercial cover		823	0	
Total productive forest		**697,736**	**57**	
Reductions to Productive Forest				
- old growth management areas	65,677	65,677	5	9
- WBSRMP Grizzly bear habitat	9,362	9,362	1	1
- Cultural Heritage Resource	1,150	898	0	0
- Environmentally Sensitive Areas (ESAs)	45,247	32,756	3	5
- inoperable areas	188,779	123,527	10	18
- low timber growing potential	56,711	32,764	3	5
- problem forest types	4,727	4,213	0	1
- deciduous leading stands	46,872	42,731	3	6
- riparian management areas	91,022	21,342	2	3
- specific geographically defined areas	33,594	15,912	1	2
- existing roads, trails and landings	27,560	8,463	1	1
- Kispiox LRMP Goat and Grizzly objectives	42,736	12,253	1	2
Total reductions to Productive Forest		369,899	30	53
Current timber harvesting landbase		**327,837**	**27**	**47**
Future road reductions		11,958		
Long term timber harvesting landbase		**315,879**		

Table 2b Area not administered by MoFR and parks/protected areas

Land type	Hectares
o Private- crown grant o Indian Reserve o UREP o Woodlot licenses o Crown lease	45,604
o Crown Provincial Park Class A and misc reserves	104,394
Total	**149,998**

[7] Kispiox TSR3 Timber Supply Analysis Report, March, 2007

2.3 Inventory History and Issues

The last inventory completed within the Kispiox TSA was conducted in 1992 and has been regularly updated for depletions and growth on a yearly basis since then (the last update was in 2005 for inclusion into TSR3). The forest inventory was completed to "traditional" inventory standards and "rolled over" into VRI format. Although the data is in VRI format, many of the VRI data attribute fields remain unpopulated, as no information was available from the traditional inventory database nor has any new data been gathered, with the exception of various habitat mapping projects specific to particular areas and species[8].

2.3.1 Inventory Audit

An inventory audit was completed in 1999 and assessed the overall accuracy of the then-current (1992-1993) inventory. Three components were tested: the timber volumes of the mature forested area, the site productivity of immature stands, and the area classified as non-forest (lakes, gravel pits, alpine meadows, etc.).

Mature Volume Component

For the mature component (comprising of both the operable and inoperable landbase), accuracy of the mature timber (>60 years) volumes were assessed and found that there were **no statistically significant differences** between the audit sample volumes and the inventory volume estimates.

Operable landbase

A **statistically significant** difference between the audit volumes and the inventory volumes for the operable component of the landbase was found in the audit. A further investigation completed found that a bias existed the forest attribute (height) used to calculate volume.

Inoperable landbase

For the inoperable landbase, there were **no statistically significant differences** between the audit sample volumes and the inventory volume estimates.

Immature Volume Component

For the immature component (stands <60 years of age), an examination of the site index was completed. The audit results concluded that the immature site index assignment **may not be accurate**.

Non-forest Inventory Classification

The non-forest classification portion of the audit was not completed.

[8] Habitat mapping data has not been incorporated in to the VRI.

2.4 **Forest Management Issues**

The following forest management issues were highlighted in the most recent timber supply review document (TSR3 Rationale for AAC determination, December, 2007) and/or brought forward by the Kispiox TSA stakeholder group in the November, 2007 stakeholder meeting and follow-up discussions. Most of the issues can indeed be addressed with a completed VRI, however some cannot. These issues are later summarized in Table 3, where it is clearly identified whether or not a particular VRI component can help resolve that issue.

1- **Cedar component**: in stands where cedar comprises less than 50% of the stand composition, the cedar component is not adequately represented in the current inventory in terms of volume or quality. This issue itself, is multi-dimensional:
   a. the *spatial location* of the minor component is important in the management of this species: cedar, as it is observed on the ground in this TSA, exists as both small, contiguous patches (2-3ha) within a stand and as dispersed throughout a stand. While the current inventory may capture the dispersed cedar, it often does not identify the individual patches. Knowing the spatial location of these patches is important to adequately manage this important tree species;
   b. The current method of estimating volumes for the third and fourth species in any inventory is based on the leading species age, height and site index values. This produces unreliable volume estimates for those species that are not the leading or second species. With great regularity, when cedar is a minor component of the stand, the estimated volumes are believed to be over estimated[9] in this TSA.;
   c. Tree quality is a very important factor for all species within this TSA. Individual species quality is not reflected in the current inventory. The ground sampling portion of a VRI would provide some information regarding quality, such as log grades, log lengths, percent sound for each identified log[10] as well as a measure of hidden decay that could be used to develop a more complete picture of stand quality for this (and other) tree species;
   d. The Chief Forester identified in his TSR3 AAC Rationale that the establishment of reliable estimates of cedar is a high priority and suggested that a cedar strategy be developed and implemented. The stakeholders in this TSA are in the early stages of developing a cedar strategy, and a VRI is required to support this initiative by providing more accurate and reliable stand attribute information in their plans and analyses.

2- **Balsam species differentiation**: the balsam profile in the current inventory regularly lacks the distinction between Abies lasiocarpa and Abies amabilis particularly in transitional stands in the southern portion of the TSA. A better species distinction between the balsam:

[9] Based on stakeholder input. No formal studies have been completed.
[10] Log grades, log lengths and percent sound information is collected at each VRI plot and may be extrapolated to the stand and/or forest level.

a. is important for operational planning as A. lasiocarpa is delivered to processing facilities in the eastern portion of the TSA and A. amabilis is directed to facilities in the western portion;
b. is significant for addressing numerous Revenue Branch issues regarding appraisals in the TSA; [11]
c. is an aid in log flow planning and analysis;
d. improves species diversity information in the TSA for purposes of wildlife management and biodiversity, as well as contributing to the existing ecosystem recovery project that compares: overstorey and understorey species composition, coarse woody debris, timber attributes and many other attributes, some of which are captured within the VRI Phase I and/or Phase II.

3- **Operable landbase**: stands within the Kispiox TSA range from good quality sawlogs to poor quality timber that can only be used for fibre or pulp. In addition, some portions of the TSA are fairly remote with poor access, and are thus subject to high logging and hauling costs, rendering many stands uneconomical to harvest. Individual stand attributes in conjunction with the geographical location of stands are both considered when determining the operable landbase for TSR and other planning purposes. Of specific concern was the stand attribute height (and thus, site index[12], which is derived from stand age and height), an attribute currently used for identifying the merchantability of older hemlock and balsam stands through volume calculations. This particular stand attribute was found to contain bias, producing an unreliable calculation of operable timber volume (an overestimation). A more accurate stand height would improve identification of the operable landbase for incorporation into TSR and other planning analyses.

4- **Deciduous stands**: The current inventory does not adequately portray stand age or densities of these stand types. Improved estimates of these two stand attributes would:
   a. aid in planning for the maintenance or enhancement of hydrological integrity within watersheds;
   b. aid in planning for wildlife habitat and species diversity;
   c. support varying interests in securing deciduous licensees in the TSA, if there is an interest; and
   d. allow the Chief Forester to determine a harvest rate for a deciduous apportionment volume for the TSA. Currently there is no deciduous harvest rate specified in the timber supply of TSR3.

5- **Hydrological integrity of watersheds:** The Chief Forester strongly recommends MoE staff continue their work in the identification of Fish Sensitive Watersheds and Critical Fish Streams in the TSA, and that MoFR staff correlate the findings of the Interior Watershed Assessment Procedures (IWAP) with the timber supply modeling assumptions for incorporation into the next AAC determination of 2013 (Kispiox Timber Supply Area, Rationale for Allowable

[11] While this issue may be a cruising issue, it is possible to utilize data collected under the VRI program that can be used to support changes in the current appraisal methods within the TSA, most notable with regards to these particular balsam species.
[12] Site index in mature stands was not assessed in the inventory audit.

Annual Cut (AAC), 2008). Improved stand attribute estimates would support in these initiatives by:

a. providing more reliable Site Index values (which are used to determine years to green up);
b. providing more reliable stand attributes (such as age, height, species composition) for all forested stands in the TSA, resulting in more reliable data inputs into various modeling assumptions.

6- **Wildlife Habitat Areas:** the Chief Forester identified the need for MoFR, MoE and other agencies and licensees to complete the work required to identify and spatially locate Wildlife Habitat Areas and other habitat requirements necessary to meet Identified Wildlife Management Strategy (IWMS) objectives so that they can be modeled appropriately in the next timber supply analysis of 2013.

7- **Protected Areas and Parks:** the ecological values of the Protected Areas and Parks provide important contributions to the TSA in terms of habitat, species diversity and ecosystem representation. The current inventory for these areas have a 1992 vintage, and do not contain any of the new non-timber attributes currently collected in a VRI.

8- **Base Map Inaccuracies:** There are spatial inaccuracies in the mapped forest polygon boundaries relative to the true ground location. This inaccuracy is due to several factors:

a. The 1992 Kispiox inventory line collection phase used a process known as monotrestitution. This process involved digitizing photo interpreted lines off aerial photographs. The spatial accuracy of this technique is +- 10-20 meters;
b. The base map that was used to register the photos for line collection was NAD27, as NAD83 (the current base map projection) was not yet available;
c. When NAD83 became available, a map to map transfer occurred though an automated process commonly referred to as ‘rubber sheeting’. The process of ‘rubber sheeting’ has resulted in spatial inaccuracies of up to 50 meters in longitude and up to 100 meters in latitude, a spatial error that is added onto the existing +- 10-20 meters of error associated with the monorestitution process.

Currently, VRIs being completed employ softcopy photogrametry technology where capturing spatial polygon linework is collected directly by the photo interpreter. This new technology includes registering the digital orthophotos to the NAD83 base map and provides spatial accuracies nearing +-15 meters from the true location.

9- **Tree Heights:** Based upon the audit findings, tree heights are overestimated in the current inventory. Tree heights are used directly in volume estimations and various forest analyses.

10- **Environmentally Sensitive Areas (ESAs):** The VRI currently does not use the ESA classification, therefore this information must be taken into account through other resource inventories.

11- **Site Productivity:** Site productivity is underestimated in the current inventory. and is a significant parameter for determining volume estimations and various forest analyses including harvest rates (AAC). Site productivity can be estimated through the VRI products and adjusted for by the Phase II plots and a further sampling program (Site Index Adjustment (SIA) or SIBEC). If SIA is utilized, the product is spatial by nature, as it ties directly to the VRI. If SIBEC is used, then a spatial product is required, such as a PEM or a TEM, to provide ecological units (site series). In his AAC Rationale, the Chief Forester suggested:

a. completing a PEM or TEM throughout the TSA;
b. correlate the PEM or TEM data with SIBEC values; and
c. to use the adjusted site indices in analyses that verifies the magnitude of additional volumes projects to become available in the mid and long terms.

The end product of both a Terrestrial Ecosystem Mapping (TEM) project and a Predictive Ecosystem Mapping (PEM) project is the same: a spatial ecosystem map of the project area. The approaches, however, are vastly different, as can be the reliability assessment results of the two end products.

TEM, like VRI, includes assigning attributes to each polygon delineated on the landbase using softcopy or the use of a stereoscope. The polygon boundaries of a TEM are generally much larger than a VRI, however, attempts are usually made in the completion of the TEM and/or VRI product to have the outer polygon boundaries of the TEM match those of the VRI (or vice versa). Each delineated TEM polygon will have the ecologist interpret the ecosystem and assign the proper attributes describing that ecosystem. The TEM method also includes a rigorous field component that the ecologists use to help in their interpretation of the ecosystems on the landbase.

PEM, on the other hand, involves creating what are called ‘knowledge tables’ that have strong ties to the forest inventory (they are dependant on the forest inventory as the main source of information). These ‘knowledge tables’ are a series of rules or conditions developed by the ecologist that have a scoring system of probabilities attached to each rule or condition. The ecosystem for the individual polygon is assigned by an automated process of summing up these scores, producing an ecosystem that is ‘most likely’ to occur on the ground in that polygon. Unlike the TEM process, there is no minimum field sampling required, and the ecologist does not interpret each individual polygon, but instead relies on their developed knowledge tables and forest inventory attributes to assign an ecosystem.

Reliability assessment results of the two approaches are not covered in this document, however it has been found that a TEM product is generally more reliable[13] than a PEM product.

[13] In order for TEM or PEM products to be used in the base case of a TSR, they must pass reliability assessments that are conducted to the approved MoFR standards. If they do not pass the reliability as outlined in the provincial standards, the information can only be used in sensitivity analyses.

A new method for developing a PEM product has recently been tested and modified over the past 4-5 years that places less emphasis on the forest inventory data. Several PEM projects have been successfully completed to date with this new method that places more focus on classifying landforms utilizing other input data (TRIM), rather than relying on a forest inventory data layer as the main source of information. Some early reliability assessment results on completed projects are finding that the products produced using this new landform classification method are often more reliable than the 'traditional' approach of using the forest cover as the main input layer. In light of this, the stakeholders are encouraged to track the recent reliability assessment results of PEM projects completed within the past 1-2 years to determine if the new landform classification method is indeed producing a more accurate map product and if this approach would likely produce a reasonable accurate[14] PEM product in their geographic area. Following this methodology would mean that the implementation of a PEM project is not reliant on the completion of a VRI; that both projects can be initiated at the same time.

The costs associated with a TEM product is between $1.75/ha-$2.20/ha plus helicopter costs, as compared to $0.44/ha-$0.65/ha for a PEM product. The estimated costs of completing a TEM in the Kispiox TSA are between $2,135,000-2,684,000 (excluding helicopter costs) while the estimated costs of completing a PEM are between $536,800-793,000 (excluding helicopter costs).

10- **Forest health:** The impacts of the following forest health issues are not reflected in the current inventory:

Balsam bark beetle (*Dryocoetes confusus*)
Dothistroma needle blight (*Mycosphaerella pini)*
Mountain pine beetle (*Dendroctonus ponderosae)*
*T*ometosus (*Inonotus tomentosus)*

11- **Operational Adjustment Factors-** The default used in the TSR process is currently considered to overestimate the OAF1 value, based on sampling studies carried out on similar sites in the adjacent Bulkley TSA.

12- **Stands <60 years of age**: the polygon attributes within this age group (immature stands) are not reliable.

13- **Culturally Modified Trees**: The identification of CMTs are currently not part of the VRI program.

14- **Sawlog/non-sawlog harvest:** In the TSR3 AAC rationale, the Chief Forester directed the MoFR staff to monitor the relative proportions of the sawlog and non-sawlog harvest in the TSA. This request was made should he need to revisit his determination for purposes of identifying particular volumes attributable to the various quality components of the harvest.

[14] There are provincial accuracy assessment values that a PEM or TEM product must meet prior to this product being deemed acceptable for use in the Base Case TSR process. If the product does not meet or exceed these values, the product can only be used in a sensitivity run.

The above noted fourteen (14) forest management issues have been summarized in the following table (Table 3). The 'Comments' column provides more details describing the management issue and the 'VRI Component' column identifies the VRI activity that would best address the issue.

Table 3 Summary forest management issues for the Kispiox TSA related to the inventory

Issue	Sub-issue	Comments	VRI Component
Cedar Species	spatial location	Delineation of distinct and recognizable cedar types within the ICHmc1, ICHmc2 and CWHwx2 subzones will be identified to a minimum polygon size of 2ha (within the standard VRI guidelines) to provide support in the development of a cedar strategy within the TSA.	Phase I
	Volumes as a minor species	Currently Cedar is generally a 3rd or 4th species in most inventory stands. Therefore inventory descriptions of the cedar component are not very accurate as attributes primarily describe the first and second species. Developing and implementing a Cedar strategy is a major concern in the TSA, A Phase I would help isolate small patches of cedar leading stands resulting in better descriptions of ages and heights of cedar being captured in the inventory. The phase II may further improve these attribute of cedar[15].	Phase I and Phase II
	Log/tree quality	NVAF data collected will be used to quantify hidden decay and determine tree quality. Additional quality information is collected at the Phase II plot level, however this is not tied back to the inventory. Data collected on the ground plots can be used in combination with a more rigorous project that can result in assigning log quality information to the inventory.	Phase II NVAF
	Cedar Strategy	The current inventory lacks sufficient or reliable inventory cedar data to develop a cedar strategy. A Phase I and Phase II is required as a basis for the development and implementation of a Cedar Strategy by providing a more reliable inventory. This more reliable inventory would enable a better differentiation of forest stands that are considered as contributing to the development of a Cedar Strategy, as well as their contributions through time through growth projections.	Phase I and Phase II

[15] Adjustments are applied to the population, so attributes in individual polygons may or may not be improved.

Balsam species differentiation	Lack of species differentiation	A Phase I combined with a phase II would solve this issue by providing a proper species identification of these two species. Utilizing only a Phase II would not allow for the species differentiation, therefore a Phase I is required. The combination of a Phase I and Phase II would provide more accurate attributes and volume estimates.	Phase I and Phase II
Operable landbase	Merchantability of older hemlock and balsam stands	A Phase II would provide information that can be used to better define the operable landbase[16]. The information could also be used to support further analyses of the criteria (attributes) used to define operability.	Phase II
Deciduous	Requires more accurate information on age and density of these stands	The current inventory does not provide accurate information on deciduous stands. A Phase I would provide more accurate stand attributes in these stands. A Phase II would provide the necessary information used to statistically adjust the attributes.	Phase I and Phase II NVAF
Hydrological Integrity of Watersheds	Identification of sensitive watersheds and correlate findings of IWAP procedures with TSR modeling assumptions	A Phase I would provide more accurate stand descriptions in younger stands and site productivity estimates, which are related to green-up and the forest's ability to maintain or enhance hydrological integrity. A Phase II would statistically adjust the attributes used to help identify sensitive watersheds, creating more reliable attribute estimates[17].	Phase I and Phase II
Wildlife Habitat Areas	Identify and spatially locate WHAs and other habitats used to support IWMS objectives so that they can be modeled appropriately in the TSR4.	WHA are identified with a combination of TEM and VRI attributes. Several VRI attributes were developed with wildlife considerations. A Phase I would provide non-timber attributes that would help in the identification and spatial location of WHAs and other habitats. Phase II would statistically adjust several timber attributes used in these identifications.	Phase I and Phase II
Protected Areas and Parks	The ecological values of the PAs and Parks are important contributions to the TSA. The current inventory does not include the non-timber attributes of a VRI.	Non-timber attributes would be made available through a completion of a Phase I. These attributes can be used to support wildlife habitat mapping projects. The timber attributes of a VRI would provide more reliable timber attributes for undertaking contribution analyses for OGMAs, habitat and ecosystem representation.	Phase I

[16] Operability of a stand is determined by many factors, one of which is the inventory.
[17] Adjustments to inventory attributes are applied to the population, therefore attributes in individual polygons may or may not be improved.

Inaccurate forest stand boundaries	The current inventory forest stand boundaries are inaccurate due to lower level instruments used and due to the map datum shift from NAD27 to NAD83.	Completing a VRI Phase I will increase stand boundary accuracy as the boundary lines will be collected directly by the photo interpreter on a NAD 83 base with more accurate technology.	Phase I
Tree heights	Tree heights are overestimated on average.	Both a Phase I and Phase II could solve this issue by producing more reliable tree heights in the Phase I that are later statistically adjusted using the Phase II data.	Phase I and Phase II
ESAs	ESAs are not in the VRI	A VRI would not solve this issue, other than possibly providing attributes that *could* be used to support the development of an ESA-type attribute.	Neither
Site Productivity	Site productivity is underestimated in the inventory	A Phase I would provide more reliable species, ages and heights (attributes used to assign site index). The Phase II would provide the necessary data for the statistical adjustment of the attributes used to determine site index. Should a TEM/PEM be undertaken (and depending upon the methodology chosen) the VRI could provide the key input layer for this initiative.	Phase I and Phase II
Forest health	Balsam bark beetle, Dothistroma needle blight, mountain pine beetle and tomentosus currently impact various tree species.	To some extent, the Phase I may be able to identify mortality impacts of these forest health issues be identifying snags (mortality potentially due to forest health[18]). To some extent, the Phase II would collect forest health information that can be used to create a broad (TSA) summary of the forest health impacts.	Phase I and Phase II to some extent
Operational Adjustment Factors	The TSA defaults for OAF1 overestimates the actual OAF value believed to exist.	The VRI does not directly mitigate OAFs, but it can contribute in a positive manner by providing: - more accurate crown closures, ages, heights (used in volume estimations) - tree pattern attributes and snag values that can to used to investigate OAF values further; - potentially smaller polygon sizes; - volume estimates from VDYP7 (this yield model is more sensitive to less than fully stocked stands)	To some extent, Phase I

[18] Numbers of dead trees are estimated for each treed polygon, however the cause of mortality is not captured in the VRI photo interpretation program.

Stands <60 years of age	The polygon attributes (age, height) for immature stands are not reliable.	A Phase I would help address this issue by delineating actual stand/opening boundaries, estimating stand attributes and/or transferring silviculture data from other sources, making these immature stands more reliable. A Phase II usually samples stands >30 years of age, so only a portion of these immature stands would be statistically adjusted with the Phase II ground data.	Phase I and Phase II (for stands >30 years of age)
Culturally Modified Trees	Training of VRI samplers to identify CMTs.	CMTs are not specifically targeted in VRI. It is not possible to identify CMTs in Phase I. In the Phase II, the training for identification of CMTs is done locally, where required. From a protection perspective, if CMTs are selected as NVAF trees, then consultation with the appropriate FN group will need to occur regarding their felling and sampling. An alternative and preferred method would be to develop a replacement protocol for replacing these selected NVAF trees with other non-CMT NVAF trees[19]. Felling of non-CMT NVAF trees within close proximity of CMT trees should not impact the remaining CMT trees on the site.	Phase II NVAF
Sawlog/non-sawlog harvest	Monitor the relative proportions of the sawlog and non-sawlog harvest in the TSA. Identify particular volumes attributable to various quality components of the harvest for inclusion in TSR4 (if required).	More accurate stand attributes from a Phase I (further adjusted by a Phase II) will provide refined delineation and stand attribute information that can be used to better define marginal volume types and values (sawlog/non-sawlog).	Phase I and Phase II NVAF

2.5 **VRI Activities and Products**

The current inventory within the Kispiox TSA does not meet the existing or future needs of the stakeholders with regards to resource management. The recommended VRI activities and products needed for addressing the identified forest management issues are listed in this section. These recommendations are based on the issues identified in Table 3 and Section 3.4, including the discussions at the stakeholder meeting and further discussions held with the stakeholders and a review of the Chief Forester's AAC Rationale for TSR3 dated January, 2008.

[19] If CMTs are deemed inoperable (not eligible for felling and sampling in the NVAF program), replacement rules around NVAF selection and replacement need to be identified in the Phase II VPIP.

1- Complete a VRI Phase I utilizing the colour 1:20,000 aerial photos captured within the 2006 fiscal year. A small portion in the northern part of the TSA does not have aerial photo coverage at this time (Figure 1). This remaining area is planned to be flown and funded through the licensee FIA allocation in the 2008-2009 fiscal year.
   a) Delineation of distinct and recognizable cedar types within the ICHmc1, ICHmc2 and CWHwx2 subzones will be identified to standard provincial VRI inventory guidelines minimum polygon of size 2 ha. This finer polygon delineation may help address some of the issues identified under Section 3.4 of this document with regards to the cedar component in this TSA and may provide support for the development of a cedar strategy within this TSA.
2- Update historical silviculture data, including the correct positioning of external openings, by utilizing relevant existing data in combination with photo interpretation of external boundaries, where required.
3- Undertake Phase II ground sampling in the vegetated treed areas of the TSA, excluding Parks and Protected Areas, to provide a statistically adjusted Phase I inventory.
4- Conduct Net Volume Adjustment Factor (NVAF) sampling to statistically adjust the volume attribute for hidden decay and taper equation bias.
5- Complete an inventory analysis and statistical adjustment to the Phase I attributes.

3 Inventory Plan

3.1 Overview

This section outlines a strategic inventory plan to develop the identified VRI products discussed in Section 3.5. The VRI products include a new VRI Phase I over the entire Kispiox TSA. It also includes conducting a timber emphasis Phase II sampling program in the operable and vegetated treed landbase. The final activity planned is an inventory analysis and statistical adjustment to Phase I attribute estimates.

3.2 Photo-interpretation (Phase I)

Objective

For purposes of addressing the identified forest management issues within this TSA, the objective is to produce a more accurate forest inventory in terms of species differentiation, site index, height and volume of the Kispiox TSA.

Target Area

The entire Kispiox TSA should be updated to VRI standards through new photo interpretation, including Parks and Protected Areas, excluding private land. It is understood that the policy on FIA funding of VRI activities in parks is currently being reviewed and therefore the target area for Phase 1 will be revisited when preparing a Phase 1 VRI Project Implementation Plan.

It was identified at the stakeholder meeting that there are preliminary discussions within the Ministry of Forests and Range to amalgamate the Cranberry TSA with the Kispiox

TSA. A thorough review of the inventory issues and management concerns within the Cranberry TSA is outside the scope of this report, therefore it is being recommended that the inclusion of the Cranberry TSA in the future VRI activities of the Kispiox be reevaluated under a separate VSIP or by an amendment of this VSIP. The area within the Cranberry TSA is approximately 76,750 ha. This equates to approximately 5.5 mapsheets.

Target Attributes

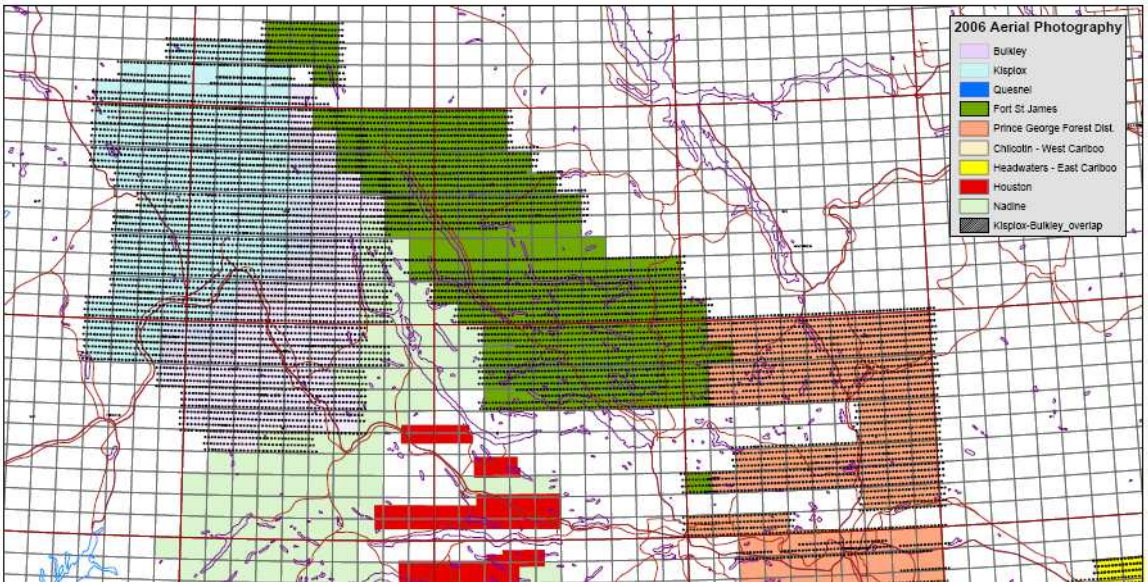
All attributes identified in the VRI standards will be collected to the required, most current provincial standards as described in the *Vegetation Resources Inventory Photo Interpretation Procedures* manual and all applicable addendums with particular focus on attributes that were identified in the inventory audit as being either over or underestimated in the past inventory and ones that are specifically required to address the identified forest management issues.

Methods

The Phase I inventory will be completed according to the most current MoFR standards using softcopy technology. 1:20,000 Colour aerial photographs captured in 2006 are available for most of the TSA area. Viewer models for the available photos have already been created, therefore there are no costs associated with this task in the proposed budget.

Approximately 17% of the TSA or 15 mapsheets in the northern part of the TSA requires aerial photography (Figure 2). Costs for acquiring these photographs have been included in the proposed budget, should they be required.

Figure 2 indicates the current aerial photo coverage for the Kispiox TSA (solid light blue indicates areas without recent coverage)



Air and ground calibration will be completed by the photo interpreters scheduled to complete the Phase I for purposes of gaining local knowledge and to improve their VRI attribute estimation. Field calibration should predominantly target stands not calibrated in

the previous inventory and in those stands where the age and height information requires more attention.

Aerial photographs have already been captured and are ready to be used (viewer models have been prepared) for approximately 83% of the TSA. The remaining air photos and model set ups should be made available shortly after they are flown in the summer of 2008.

3.3 **Quality Assurance - Phase I**

The quality assurance component of the VRI includes the use of a third-party independent certified VRI photo interpreter to verify the deliverables for the following phases:

- delineation;
- ground and air calls associated with the photo interpretation;
- attribute estimation; and
- the spatial mapping component

The approximate costs for this service of auditing are included in the budget table. A separate independent audit is conducted on the Phase II ground sampling.

3.4 **Implementation**

A VPIP for the Phase I will need to be developed, following the MoFR guidelines: *Vegetation Resource Inventory Guidelines for Preparing a Project Implementation Plan for Photo Interpretation.* This document will provide details including: whether or not the costs associated with capturing the remaining orthophotography is warranted; the attributes to be collected in the Phase I including the delineation process, the use of calibration data sources, existing photos, and current technologies to be used in undertaking the Phase I. Priority areas will also be identified, if any, providing more detailed direction to the implementation of the Phase I.

3.5 **Ground Sampling (Phase II)**

Ground Sampling Objectives

The main objective of the ground sampling is to install an adequate number of Phase II sample plots required to statistically adjust specific attributes within the Phase I photo interpretation. The total number of VRI samples will aim to achieve a minimum sampling error of +- 10% (95% probability) for net merchantable timber volume and allow for calculation of sampling errors for other VRI attributes, therefore enough samples need to be installed to achieve this target.

In order to obtain a completed VRI at a reasonable cost, Timber Emphasis Plots (TEP) will be installed at each identified location and may include data collection on some or all

of the following attributes: coarse woody debris, range and ecology. These details will be finalized in the VPIP.

Call grading to interior log grading standards[20] will be included in the ground sampling program at the Integrated Plot Centers (and NVAF sample trees, discussed later) in order to obtain log quality information to help address timber quality issues identified by the stakeholders.

Additional samples will be considered during the VPIP development stage and will be based on:
- the need to collect more information in certain populations;
- the need to reduce the sampling error.

The NVAF destructive sampling component of Phase II is designed to statistically adjust VRI ground sample volumes to correct for errors in the estimation of net close utilization volume caused by hidden decay and taper equation bias. The net volume estimate assigned to forested polygons in a forest inventory is the gross volume of the stand less stumps, tops, decay, waste and breakage. The decay and waste portion will be estimated using VRI call grading/net factoring and NVAF sampling, as well as completing the call grading to interior call grading standards. This extra data collection (to interior call grading standards) will help address the log quality issues identified in this TSA.

3.6 **Quality Assurance- Phase II**

The quality assurance component of this Phase of VRI also usually includes the use of a third-party independent certified VRI sampler who checks the following:

- Plot location and establishment;
- Data collection;

An estimated cost for this service of auditing (for the Phase II ground samples) is included in the budget table.

3.7 **Target population**

The target population will be the operable and inoperable vegetated treed (VT) portion of the TSA, excluding Parks and Protected Areas. The inoperable landbase is included as part of the sampling population for the following reasons:

1) the definition of ‘inoperable’ is variable depending upon economic conditions. Inoperable stands may become operable in the future.
2) potential harvesting opportunities in this portion of the TSA may exist; and
3) wildlife habitat may be represented by this area.

[20] Current VRI standards for call grading are different than interior or coastal call grading standards, therefore the addition of completing call grading to interior log grading standards is considered a non-standard VRI data collection. Variances for non-standard data collection will likely not receive funding through the Forest Investment Account.

Approximately 80% of the samples should be located in the operable portion of the vegetated treed landbase. Private land will be excluded. Only that portion with >10% crown closure and over 30 years old will be sampled.

Approximately 20% of the samples should be located in the inoperable vegetated treed landbase. The exact area to be sampled will be further examined during the preparation of the VPIP to determine if other limits for volume or elevation should be considered.

The population will be pre-stratified based on species or species groupings that reflect both the actual species composition of the landbase and stakeholder interests. Each individual stratum must be of sufficient size in the population to derive adequate sampling to reach a conclusion that will be statistically significant, as would be discussed in the analysis.

3.8 **Sample Size**

Based upon the current species distribution used for TSR 3 as shown in section 3.2 and to expressed stakeholder interest in specific species group, the suggested landbase stratification for the Kispiox TSA is as follows:

Stratum	**Approximate number of samples**
Hemlock	30
Balsam	29
Spruce	8
Pine, minor species	7
Cedar	10
Immature- all species	20
Total samples	***104***

For sampling in the immature component of the TSA, an additional 30 samples would be established in stands 31-80 years old (immature) across all coniferous species types. Stands less than 30 years would not be sampled

Any individual sub-populations within the matrix that are too small to have their own individual stratum would be combined with a closely associated stratum (species group or age range). The actual number of samples will be determined in more detail in the VRI Phase II sampling plan developed as part of the VPIP.

3.9 **Sampling Approach**

The VRI ground plots to be established should consist of predominantly Timber Emphasis Plots (TEP) for all plots established.

For the NVAF component of VRI, there can be significant cost efficiencies realized through the enhancement of trees for the NVAF program at the time of the establishment of the Phase II plots, rather than at the time of the NVAF destructive sampling. This should be considered by the stakeholders and incorporated into the VPIP and Phase

II/NVAF Sample Plan. Certified VRI Phase II samplers will conduct detailed enhanced cruising (net factoring and call grading) of all trees in the auxiliary plot during ground sampling.

3.10 **Sample Selection**

For selecting the sample polygons, the MoFR approach 'probability of selection proportional to size with replacement (PPSWR)' will be followed. The applicable document that details this selection procedure is *Sample Selection Procedures for Ground sampling v3.3, December, 2002.*

3.11 **Net Volume Adjustment Factor Sampling**

The overall objective of this VRI activity is to complete destructive sampling to statistically adjust VRI ground sample volumes in order to correct for any errors in gross and net volume. A secondary objective is to obtain local information on hidden decay, waste and stem taper. These data will later be used to adjust the initial adjustments of net volume in the Phase II.

Completing net volume adjustment factor (NVAF) sampling is a requirement under the current VRI standards. There is some flexibility, however, regarding the timing of this sampling. This particular type of sampling includes the destructive sampling and detailed stem analysis of selected sample trees, the subsequent calculation of net volume and the calculation of the ratio between the actual net volume (from NVAF samples) and estimated net volume (from the Phase II). This ratio will be used to statistically adjust the estimated net merchantable volume of the VRI phase II samples.

A minimum of 120 trees (approximately 110 live and 10 dead) are selected from the established VRI Phase II auxiliary plots. Approximately 35 Phase II ground samples will be enhanced for NVAF. The VPIP will provide additional details on the stratification used for selecting the trees for destructive sampling, however, it should be noted that there are particular concerns in the loss factors for the mature cedar in this TSA, therefore an adequate number of samples in this stratum should be collected.

Stratum	**Number of Sample Trees**
Hemlock	20
Balsam (Bl)	20
Balsam (Ba)	20
Cedar	20
Other species	20
Immature	10
Dead	10
Total	**120**

3.12 **Quality Assurance – NVAF**

The quality assurance component of this phase of the VRI usually includes the use of a 3rd party independent certified NVAF sampler, approved for QA by the MOFR. An estimated cost for this service of auditing is included in the budget table.

3.13 Inventory Statistical Analysis and Adjustment of Photo interpreted Estimates

In order to create a statistically valid final inventory product that combines the information from the Phase II sampling with the Phase I interpretation, an adjustment to the phase I data for the entire VRI project area will be completed.

3.14 Implementation of the Phase II

An implementation process is outlined below:

1. complete a Phase II VPIP according to the most recent provincial standards and following the guidance of the approved VSIP (this document).
2. compile a list of all polygons within the TSA and identify those that will form the target population.
3. Stratify the population by the criteria of interest (suggested strata were provided in Section 4.6 'Sample Selection') and allocate the samples to each stratum.
4. Select sample polygon locations using the PPSWR process.
5. Select a random plot location within the selected sample polygons.
6. Identify the ground samples that will be NVAF-enhanced and also have ecological data collected.
7. Prepare sample packages.
8. Establish and collect data from ground sample plots.
9. Complete quality assurance of the field data collection and procedures during the field sampling component.
10. Submit complete Phase II plots to the MoFR.
11. Compile the Phase II data.
12. Complete the interim analysis to determine if additional ground samples are required to achieve the stated precision.
13. Prepare the NVAF sampling matrix and identify the NVAF trees.
14. Complete NVAF sampling.
15. Complete quality assurance of the field data collection and procedures during the NVAF sampling portion.
16. Compile all data.
17. Complete the statistical adjustment of the Phase II and report the results.
18. Submit results to the MoFR.

3.15 **Summary of costs**

A summary of costs for completing the VRI products for the Kispiox TSA is provided in table 4. More detailed costs will be developed and presented in the VPIP.

Table 4. Total Estimated VRI project costs

Total # of Mapsheet equivalents 88

Total Area 1,232,000

First Approximation of Budget and Schedule

VRI Phase/Task	Inventory Activity	Unit	# Units	Unit Cost $ / Unit	Total Cost $	Comments
I	**Photo Acquisition, Aerial Triangulation, Scanning, Proj. Mgmt**	mapsheet	15	4,807[21]	72,105	Based on having to re-fly two lines in the northern portion of TSA. This will make AT most cost and time efficient. Includes 10% proj. mgmt fees.
I	**Phase I VPIP**	TSA		15,000	15,000	Based on historical rates.
I	**Photo Interpretation**	hectare	1,232,000	1.52	1,872,640	Based on historical rates.
I	**3rd party Quality Assurance**	hectare	1,232,000	0.05	61,600	Based on historical rates.
Total Phase I Photo Interpretation Costs					**2,021,345**	
II	**Phase II VPIP**	TSA		20,000	20,000	Includes sample design and sample package preparation. Based on historical rates.
	Ground Sampling	plot	104	3200	332,800	$2200 per plot costs, $1000 heli costs per plot
	3rd party Quality Assurance	plot			33,280	10% of ground sample costs
	Non-standard Data Collection (Interior Log Grades)[22]	plot			4850	0.25 hr/non-enhanced plot 1.0 hr/enhanced plot $100/hr (est)
II	**NVAF**	tree	120	1200	144,000	$900/tree + helicopter
	3rd party Quality Assurance	tree			14,400	10% of NVAF costs
Total Phase II costs- Ground Sampling component					**549,330**	
III	**Statistical analysis and adjustment**	TSA			$25,000	
Total Phase III costs- Statistical Adjustment					**$25,000**	
GRAND TOTAL OF KISPIOX VRI					**$2,595,675**	

[21] The costs associated with flying only the missing flight lines then attempting to create AT models between the new and existing flight lines is believed to be greater than the time and costs associated with re-flying the mapsheets as one entire unit. (Pers. Comm with Ken Blagborne). Therefore, the costs are based on re-flying the entire remaining mapsheets.

[22] Call grading to Interior Log Grading standards is considered non-standard VRI data collection. Variances for non-standard data collection will likely not receive funding through the Forest Investment Account.

4 Vegetation Resources Inventory Strategic Inventory Plan Approval

I have read and concur that the Kispiox TSA Vegetation Resources Inventory Strategic Inventory Plan, prepared by Forsite Consultants Ltd. and dated January, 2008, meets current Vegetation Resources Inventory Standards, business needs and considerations. It is understood that this is an agreement – in – principle and does not commit the signatories to completing the inventory activities outlined within the plan. Any major modifications to this plan will need to be reviewed and approved by the signatories.

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Date